The Claims

What is claimed is:

1. A continuous vacuum pan comprising:

a cylindrical housing having a vertical axis;

at least one liquid heating pan within the housing, the liquid heating pan having a periphery and a bottom;

a vertical tube floating calandria within the liquid heating pan, the vertical tube floating calandria having a periphery, a bottom, and a downcomer between the periphery of the calandria and the periphery of the liquid heating pan, with a gap between the bottom of the calandria and the bottom of the liquid heating pan;

radially extending baffles in the liquid heating pan defining a plurality of compartments located in series with one another, the compartments ranging from a first upstream compartment to a downstream output compartment; and

ports in all of the baffles, except in the baffle between the output compartment and the first compartment, the ports being spaced from the bottom of the liquid heating pan and permitting communication between the compartments.

2. The pan of claim 1 wherein the ports are located above a top of the calandria.

3. The pan of claim 2 further comprising guiding baffles for guiding liquid from the ports onto the periphery of the calandria.

4. The pan of claim 2 further comprising guiding baffles for guiding liquid from the ports directly into the downcomer.

5. The pan of claim 1 wherein the bottom of the liquid heating pan is substantially W-shaped.

6. The pan of claim 1 wherein the cylindrical housing is a circular cylindrical housing and the vertical tube floating calandria is circular in plan view.

7. The pan of claim 1 further comprising a vertically extending heating fluid conduit for supplying heating fluid to the calandria, with the heating fluid conduit having a vertical axis coinciding with the vertical axis of the housing.

8. The pan of claim 1 wherein each compartment has its own feed or solution inlet for feeding feed or solution separately and simultaneously into each compartment.

9. The pan of claim 1 wherein the at least one heating pan comprises an upper liquid heating pan located above, and in series with, a lower liquid heating pan.

10. The pan of claim 9 wherein a downstream output compartment of the upper liquid heating pan communicates with a first upstream compartment of the lower liquid heating pan.

11. The pan of claim 9 wherein the upper and lower liquid heating pans are in vapour communication with one another so that vapour generated by heating a liquid in the lower liquid heating pan can be removed from the lower liquid heating pan together with vapour generated by heating a liquid in the upper liquid heating pan via a common vapour zone located above the upper liquid heating pan.

12. The pan of claim 11 wherein the vapour communication is provided by at least one peripherally extending passageway located between the housing and the upper liquid heating pan.

13. The pan of claim 11 wherein the vapour communication is provided by ducts located externally to the housing.

14. The pan of claim 11 wherein the vapour communication is provided by a plurality of conduits located between the housing and the upper liquid heating pan, each conduit being in communication with its own compartment in the lower liquid heating pan.

15. A method of crystallizing the solute of a solution by evaporating the solvent of the solution in a continuous operation in a vacuum pan having a plurality of

compartments with a periphery and a bottom located in series with one another and divided from one another by radially extending baffles, the compartments ranging from a first upstream compartment to a downstream output compartment, the method including the steps of heating the solution within each compartment via a vertical tube floating calandria having a periphery, a top, and a bottom, so that the solution will flow upwardly through vertical tubes of the calandria, across the top of the calandria, downwardly through a downcomer between the periphery of the calandria and the periphery of the compartment, along a gap between the bottom of the calandria and the bottom of the compartment, and back into the vertical tubes of the calandria, and discharging excess solution from upstream compartments to downstream compartments through ports in the baffles onto the calandria towards the periphery of the calandria or directly into the downcomer.

16. A continuous vacuum pan comprising:

a generally cylindrical housing disposed about a vertical axis;

at least one liquid heating pan disposed within the housing, the liquid heating pan having a periphery, a bottom, and at least one baffle that defines a plurality of adjacent compartments;

a vertical tube floating calandria disposed proximate the liquid heating pan and having a periphery and a bottom; and

a downcomer disposed between the periphery of the calandria and the periphery of the liquid heating pan,

wherein the bottom of the calandria is spaced from the bottom of the liquid heating pan, and each compartment communicates with at least one other compartment at a location remote from the bottom of the liquid heating pan.

17. The continuous vacuum pan of claim 16, wherein the at least one heating pan comprises an upper liquid heating pan and a lower liquid heating pan.

18. The continuous vacuum pan of claim 17, wherein a downstream output compartment of the upper liquid heating pan communicates with a first upstream compartment of the lower liquid heating pan.

19. The continuous vacuum pan of claim 17, wherein the upper and lower liquid heating pans are in vapour communication with one another so that vapors

generated proximate each pan pass for removal to a common vapour zone located above the upper liquid heating pan.

20. A method of crystallizing a solute of a solution in a vacuum pan, the method comprising:

disposing the solution in a plurality of adjacent compartments that each communicate with at least one other compartment;

heating the solution;

circulating the solution via a vertical tube floating calandria comprising a periphery, a top, a bottom, and at least one vertical tube, so that the solution flows through the at least one vertical tube, across the top of the calandria, downwardly between the periphery of the calandria and periphery of a compartment, along a gap between the bottom of the calandria and the bottom of the compartment, and back into the vertical tubes of the calandria;

discharging excess solution from upstream compartments to downstream compartments.